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ABSTRACT

This report describes the development and proposed content of a new interdisciplinary course called "Science and Society," which will be offered at Central Piedmont Community College (CPCC) for the first time in fall 1976. This course will deal with the role which science and technology have played in the events which have shaped the past, and what the application of science and technology can do to provide alternative futures. It will offer credit in either science (with laboratory experience) or humanities (without). Its objectives are to make the student more scientifically literate, to have the student learn about the role of science as a cultural influence, and to have him/her observe the trends of our post-industrial society and extrapolate its future. The report describes the procedures used to develop this course. It also includes a literature review and an extensive bibliography. A questionnaire distributed to the science and humanities faculty at CPCC to obtain their feelings about the need for such a course, what its objectives should be, and for whom its should be designed is appended. Also appended are a recommended reference list for the course, a flow chart of the procedures to be followed in initiating a new course at CPCC, a tentative course outline, and a sample course evaluation form. (DC)

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A NEW INTERDEPARTMENTAL COURSE:

SCIENCE AND SOCIETY

by

Aaron McAlexander

Developed for

Department of Physical Science

Central Piedmont Community College

Charlotte, North Carolina

March 9, 1976

JC 760 169

Abstract:

A New Interdepartmental Course: Science and Society

by

Aaron McAlexander

This practicum is a result of what has been a major concern of the author for several years--the absence of effective communications between scientists and persons involved in other human endeavors. There is evidence that the looming problems of this age can be solved (non-catastrophically) if and only if our institutions are successful in educating the electorate as to what the real problems are; and that for these problems to be solved, the voices of this educated electorate must be heard over the din of lobbying vested interest groups.

The above concerns have lead to the development of a course, not in science, but about science; a course which is concerned with the role which science and technology have played in the events which have shaped the past, and what the application of science and technology can do to provide alternative futures. The course offers credit in either science (with laboratory experience) or humanities (without). As described in this report, the course has been proposed, objectives have been developed, and materials assembled. The course is scheduled to begin Fall Quarter, 1976.

It is hoped that this course will provide the sort of educational experience which is critically needed at this time; among other things, preparation for rapid and drastic change in the definition of "the good life."

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Introduction:

As one who has been involved in the instruction of science, through both the halcyon years of Sputnik and the more lean and turbulent years which followed, the author has developed an increasing concern over the apparent lack of communication between scientists and technologists and the rest of society. It is disturbing to observe sincere and intelligent people dissipating creative energy in unscientific and pseudoscientific fads and foibles such as astrology, scientology, etc. V. V. Raman (1973) expresses such a concern very clearly.

> Although science in its modern connotation has been with us for well over three hundred years and society has existed for much longer, it is only during the present century that scholarly research and popular interest have grown on the interaction between the two. So it is that although one would have expected the eradication of superstitions and bigotry from an era of scientific enlightenment, twentieth century absurdities and prejudices reveal that no such thing has yet happened.

He goes on to state at least one plausible explanation for what has occurred.

> In recent years as a result of pollution, ruthless technology, and mammoth expenditures for ghastly weapons, well-meaning people have expressed an aversion to science and all that goes with it.

The author of this report is convinced that the looming problems of the last decades of the twentieth century can be solved (non-catastrophically) in a democratic society if and only if our educational institutions are successful in educating the electorate as to what the real problems are, what potential solutions exist, and that for these solutions to be put into effect, the voices of enlightened masses must be heard over the din of lobbying vested interests groups.

Admittedly, educating an entire society is a bit of a quixotic task for one man's practicum. But the heads of the Science and the Humanities

departments at Central Piedmont Community College agree with the author, that a project could be undertaken which might be of value, both at the mundane level of helping students gain certain credits necessary for the attainment of their degrees, and at the more esoteric level of instituting a small effort toward saving the world from going to hell on roller-skates.

The product of the project is to be a course, not in science, but about science. The title of the course will probably be "science and society."

It probably requires a bit of bravado to set out to develop a course with such an ambitious sounding title. Aside from the fact that the course has to be called something, however, is the idea that "Science and Society" is really the only reasonable title for a course which has included among its goals having the student become more scientifically literate, having the student learn about the role of science as a cultural influence, and having the student observe the trends of our post-industrial society and extrapolate its future.

This course is not to serve as a replacement for any of the courses in basic science which are a critical part of the curricula for students in the science, technology, and engineering programs. But it is the opinion of the author that these basic science courses are really not designed to be of maximum value to non-science oriented students. In terms of teaching these students about the role of science in other human endeavors, and in terms of preparing them to make intelligent decisions regarding the future directions of science and technology, some basic science courses have all the value of the study of barehanded fish grabbing and little wooley horse clubbing (J. Abner Peddiwell, 1939).

It is hoped that this project will result in positive change which will both benefit the student directly in his studies and will represent the sort of educational experience which is needed at this time; that is, a preparation for rapid and drastic change.

Background and Significance:

As early as 1959, C. P. Snow was expressing concern over the widening breech of communications between the "two cultures," the technologists and the humanists. Kenneth L. Rinehart, Jr., et.al. (1973) describes a similar but more general concern which has surfaced along with the unprecedented problems of this time.

> After decades of accepting unquestioningly the virtues of science and of spending billions in funding research, the public, of late, has begun to ask, rather loudly, whether the benefits of the new technology outweigh its cost to the environment, whether genetic engineering violates higher ethical principles, and whether science offers any hopeful solution to the Malthusian spectre of overpopulation. It is not easy for the public to fund answers to these and similar questions, and it usually must choose between the facile generalities of the popular press and the hard technicalities of science textbooks.

Filling the void between "the facile generalities of the popular press and the hard technicalities of science textbooks" is precisely what this practicum is about. And although it will not silence the critics of modern technology, René Dubos (1961) attempts to justify science without technology when he states, "Granting all the good from science and its indispensability in solving complex problems--the primary relevance of science is the same as music or art--it is a fascinating study whose basic motivation lies in the desires of man to unravel the universe rather than to make life more comfortable." At the same time, V. V. Raman (1973) states that many scientists and educators have taken pains to show the relevance of science to various aspects of society.

Kenneth E. Boulding (1974) compares the current expansion of major human endeavors--science, government, economics--to a similar expansion which has been taking place in agriculture.

> In the last century and a half, we have seen an enormous expansion of agriculture, and the forest and the prarie every-

> where have retreated before the relentless advance of the field. This is not unrelated to the similar advance in science, which is a kind of mental agriculture, and of government, which is political agriculture. Science raises periodic tables, testable equations and evolutionary models and roots out witchcraft and astrology, alchemy and old wives' tales. Government grows--we hope--internal peace and controlled economics...
>
> Nevertheless, there are limits to our husbandry in the field, in the laboratory, and in the legislature. We plow up the great plains and they blow away; we push agriculture too far into the forests and we create a precarious ecosystem. Agriculture, science, and government all result in a loss of species...

Robert B. Lindsay (1963) comments on the extent to which history books are concerned with governments, wars, political leaders and international treaties. However, according to Lindsay, the major changes in the face of human civilization at large are due, in the final analysis, to advancements in science. J. Bronowski (1973) makes much the same point in his film on the industrial revolution, The Drive for Power, and in his book, The Ascent of Man.

Alvin Toffler (1970) contends that we are playing a dirty trick on our students when we subject them to an educational process which consists of hour upon hour of instructing the students in the glories of the past, giving them perhaps a flash of what is occurring at the present, but remaining silent about the future. He also contends that, although it is true that if we do not learn from history, we shall be compelled to relive it; if we do not change the future, we shall be compelled to endure it (Toffler, 1972).

Both Toffler (1970) and John T. Hardy (1975) refer to this, the 800th lifetime of modern man, which represents such a sharp break with all past human experience. Hardy (ibid) quotes Loren Eisley: "The need is not really for more brains, the need now is for a gentler, a more

tolerant people than those who won for us against the ice, the tiger, and the bear." Or to quote Pogo's most famous paraphasal, "We has met the enemy and he is us." The following quotation from René Dubos (Jennings, 1959) is an example of the dismal future which some predict for mankind.

> But it is a certainty that mankind shall experience a rapid degradation of the quality of life it represents if present trends are allowed to continue. We may escape nuclear warfare, widespread poisoning and mass hunger, but unless we act drastically and very soon, we shall not escape the progressive loss of humanness resulting from life in a closed environment which is everyday more crowded, polluted and desecrated.

There are arguments that perhaps education, per se, is not the answer. As Howard Hausman (1975) points out, "Education is a real danger if it produces large numbers of over-educated graduates...we can't have millions of people dreaming of immortality who don't know what to do on a rainy afternoon." But for the time being, the only seemingly logical course for an educator is to proceed on the premise that attempting to educate for alternative futures is a desirable thing to do.

The development of the course described in this report is by no means the first or only attempt to develop a course "about science" with which the author is familar. But quite a number of hot items has been added to the growing list of concerns since the beginnings of popularity for "Physics and Society" (Schroeer, 1973) and "Physics for Poets" (March, 1970) and such courses. There are some very fine science and society-type courses being taught in colleges and universities in the Carolinas and Virginia (Revitalization, 1972). But they, for the most part, seem to be less concerned with the environment and survival than seems appropriate for the times.

The decision to develop such a course at Central Piedmont came as a "spin-off" from a humanities-science effort in which the author was

involved, which was a course based on Jacob Bronowski's (1973) monumental film series, The Ascent of Man. There was a general, informal agreement made among the six instructors involved in the Ascent of Man course at its conclusion, that this sort of humanistic-scientific effort in education should be continued at Central Piedmont Community College. Inspirational fuel for such projects is to be found in quotations such as the following one from Frank C. Jennings (1969).

> An educator, whatever his assignment, should have an informing "vision of a desirable society." He should possess the intellectual and emotional resources to use that vision to move the existing school or class or system toward that vision.
>
> With respect to this vision, the challenge of the future is for us to make it possible to live into it undiminished, and to so manage our individual and corporate selves that the inhabitants of some father future will not curse the memory of us.

Procedure:

Although the idea of offering a course about science and its role in other human endeavors was met quite enthusiastically by the heads of both the humanities and the science departments, it was decided that the faculty in these departments should be involved in the design of the course to the greatest extent possible.

(1) Direction and Scope of the Course: A logical first step in designing the course appeared to be an attempt to determine what the science and humanities faculty perceived the needs of the society to be and what student population should be served. The author feels that, to some extent, the needs of society have been evaluated in the "Background and Significance" section of this report.

Information regarding the need for a "science and society" course, the topical emphases of the course, and the population towards whom the course should be directed (as perceived by science and humanities faculty) was obtained through the use of the questionnaire included as Appendix I of this report.

(2) Developing the Course Objectives : According to Robert F. Mager (1962), dialogue over the merits of various approaches to instruction is meaningless unless the goal which is to be attained is specified. It therefore followed that the next logical step in developing the course was to develop a set of behavioral objectives for the course. Due to the nature of the topics which would be treated in such a course, the objectives fall largely into the affective domain (Bloom, 1956). The author found the writing of this type of objective to be a very difficult task. The first draft of course objectives is included as Appendix III of this report.

(3) Evaluation of Course Objectives: In keeping with the idea of a high level of involvement of the science and humanities faculty in the development of the course, the objectives were distributed to all members of the science and the humanities departments, along with the evaluation form which is included as Appendix IV of this report. At this point it is sufficient to say that the objectives were received in both departments with, for the most part, enthusiasm and even acclaim. No objective has, so far, received negative reaction from science and humanities faculty members sufficient to merit its being discarded.

(4) Assembly of Course Materials: Once a set of course objectives had been (tentatively) established, the task of seeking out and selecting course materials followed. In the process of searching for course materials, the author of this report previewed no less than thirty-two films, over forty books, and read innumerable magazine articles on the subjects of "science and society," "futuristics," environmentalism, history of technology, and many other diverse topics which are related to the course objectives.

From this material, a list of recommended films, books and articles for the course was compiled. This list is included as Appendix VI of this report.

(5) Seeking Approval for the Course: A course may be offered experimentally on a one-time basis at Central Piedmont Community College without the approval of the Faculty Senate Curriculum Committee. However, since it is the hope of the Physical Science Department to be able to offer the course on a continuing basis, and since the development of the course had progressed to such an advanced stage, it was decided to present the course to the curriculum committee for approval. Before a

course can be added to the College curriculum, it must be processed through the stages indicated by the flowchart which is included as Appendix VII of this report.

The Central Piedmont Communtiy College Curriculum Committee requires that each member of the committee be provided with a proposed syllabus for any course submitted for approval at least one week prior to the meeting at which approval of the course is considered. A tentative syllabus, in the rather antiquated (but required) format, is included as Appendix VIII of this report.

(6) Student Evaluation of the Course: Although, due to time constraints, it will not be possible to include an evaluation of the course by participating students in this report, such an evaluation will be performed. The Physical Science Department's evaluation form, included as Appendix IX of this report, will be used in a part of this evaluation.

(7) Peer Evaluation of the Course: Although it will not be possible to include any evaluation of the course syllabus, objectives, or materials by instructors from other institutions who have had experience with this type of course, again such an evaluation is planned. The author intends to solicit opinions on the various parameters of the course from colleagues who have taught courses in "Science and Society" and "Physics for Poets" at their own institutions.

Results:

(1) Direction and Scope of the Course: The numerical results of the questionnaire relating to the scope and direction of the course are included as Appendix II of this report.

Response to the questionnaire was good; of the thirty faculty members of the science and humanities departments to whom the questionnaire was distributed, twenty-three responded. The major course parameters which were influenced by the results of this questionnaire are as follows.

(a) With fourteen of the respondents citing "tremendous need" and six responding "some need" to the inquiry relating to the need for such a course, it was felt that there was more than adequate justification to proceed with the development of the course.

(b) Response to the question relating to the "groups to whom such a course might appeal" was so evenly distributed that the author's response was to attempt to give the course the most broad appeal possible. If any particular groups are coincidentally catered to in the course, it will probably be liberal arts and teacher certification students.

(c) It was decided that the students could best be served by having the laboratory experiences in the course optional. If the student wants humanities credit, he may register for PHY 1300, which consists of three lecture hours per week with no laboratory work. If the student prefers (or needs) laboratory science credit, then he may register for PHY 1400, which consists of the same three hours of lecture per week plus two hours of laborabory experience.

(d) Although more respondents preferred team teaching to a single instructor for this course, logistics dictate that, for the initial offering, a single instructor will have to handle the course.

(e) The response to the list of proposed topics in part II of the questionnaire (see Appendix II) resulted in the following prioritization of potential course topics. These topics are listed below in order of priority, as determined by the summation of the ratings by the respondents on a zero to five scale. The summation of the ratings is indicated in parentheses to the right of each topic.

1. Technology and Quality of Life (101)
2. Pollution: Effects and Alternatives (97)
3. Population Problems (96)
4. The Moral Responsibility of Scientists (92)
5. The Energy Situation (85)
6. The Lack of Communication Between Humanists & Technologists (83)
7. Science and the Arts (83)
8. Science and Politics (80)
9. Technology and Social Structure (79)
10. The Prospect of Nuclear Annihilation (77)
11. Science and Religion (71)
12. History of Technology (68)
13. The U.S. Military Budget (62)
14. Development of Scientific Vocabulary (58)
15. The New Genetics) Suggested by respondents
16. Science and Economics)
17. Consumer Science)

It is obvious that even a cursory treatment of all of the above topics would require several courses. However, the value of the list is that it indicates the appropriate foci and directions for the course. While this priority list will not determine absolutely the content of the course, certainly the top five or six topics on the list should be emphasized. The Science and Society instructor should, at all times, remain flexible and sensitive to the interests and desires of the students in the course.

(2) Determination of Course Objectives: The list of course objectives which is included as Appendix III of this report was influenced considerably by the results of the questionnaire which was discussed in the previous section.

The response to these objectives which was received through the form for Evaluation of Course Objectives is included as Appendix V of this report. The author finds these results most flattering; not only did most of the results receive high ratings from most respondents, but a number of science and humanities faculty members have directly communicated their enthusiasm and support for the course and for the objectives particularly. The lowest rating any objective received on its general desirability resulted in a mean value of 3.44 on a scale from one to five. The lowest rating received in terms of suitability for the Science and Society course was a mean value of 4.13 on a scale from one to five, which was also the lowest rating of any objective in terms of its representing a realistic expectation of the student.

Since only sixteen out of thirty forms for Evaluation of Course Objectives were returned, perhaps this data should not be taken too seriously. But one should be able to begin teaching the course with some confidence that it is based upon appropriate objectives.

(3) Course Materials: The list of Proposed Course Materials which is included as Appendix VI of this report represents a considerable effort on the part of the author. Two books were selected from the list of course materials as being expecially usable for texts for the course. As related to the course objectives, Schroeer's (1973) Physics and Its Fifth Dimension: Society (paperback) provides a good outline and format for the course; while Truitt's and Solomon's (1973) Science, Technology and

Freedom (also paperback) provides an anthology of related material which is probably more appropriate than any the author could assemble.

These two central texts, the seventeen or eighteen recommended films, plus the additional recommended reading material (Appendix VI) means that instead of having difficulty in locating suitable material for the course, the problem is going to be selecting what is to be used from a tremendous amount of excellent material.

At this writing, all of the material listed in Appendix VI is either in the possession of Central Piedmont Community College or is currently on order. This material will be made available to students enrolled in the course on the following basis.

(a) Films will be shown in class, and then made available for further viewing on the dial access system in the Learning Resources Center on campus.

(b) A core group of approximately twelve books will be located in a carrel in the physics open laboratory. The others will be kept on reserve in the main campus library.

(c) Periodicals containing the articles in the materials list will be kept available in a carrell in the physics open laboratory. (The laboratory is kept open approximately fifty hours per week.)

(4) Course Approval: Appendix VIII of this report contains a tentative syllabus for the course. This course has been tentatively numbered PHY 1300/1400 and given the title Science and Society. The course was presented to the curriculum committee as both a non-laboratory humanities course (PHY 1300) and a laboratory science course (PHY 1400). On September 2, 1975, the course (in both forms) has been approved by the Curriculum Committee and by the Faculty Senate. It is felt that the final

stages of approval (see Appendix VII) are imminent. The chairman of the Physical Science Department at this institution is so confident of approval he is including the course in the schedule for the upcoming Fall Quarter (beginning October 3, 1976). The author of this report has been assigned to the class.

(5) Further Evaluation: Evaluation of the course objectives by several instructors in other institutions is currently underway. Student evaluation of the course will be conducted about midway through and near the end of the course during its initial offering. It is expected that the course will be modified, as a result of continuing evaluation, following both this and subsequent offerings.

Recommendations:

To one who is familiar with the traditional role of the physical science department in an institution such as Central Piedmont College, it is evident that the offering of a course such as Science and Society represents a considerable change in both philosophy and procedure. It may well be, in view of current trends in our society, that these changes represent the beginning of a significant new role for the science departments, at least at Central Piedmont Community College. It is in view of the potential of a science department to serve as an agent of constructive change in society, through the type of course described in this report, that the following recommendations are made:

(1) The course, PHY 1300/1400, should be observed and evaluated with the utmost care during its initial offering.

(2) Should the course, PHY 1300/1400, be shown to meet a significant need of the student population and the community, the possibility of expanding into additional courses (Environmentalism, Futuristics, History of Technology), or even an entire curriculum be considered.

(3) A course such as PHY 1300/1400 is a course in current situations. Materials for the exceptionally viable topics in this course are constantly being produced. It will therefore be necessary, should the course be offered on a continuing basis, to continually evaluate and revise the course objectives and the materials used in the course.

(4) Should the course prove to be a success, there are probably many other departments in the institution who could and should offer a similar type of course. For example, Life Science would certainly be the appropriate department to offer certain types of environmental courses. One can conceive of all forms of courses about, rather

than in economics, technology, etc. Therefore, information relating to the results of the Science and Society course should be accumulated and distributed to other departments in this institution. After all, a large part of the rationale for developing the course in the first place was to improve communications between the science and other areas.

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Knowledge or Certainty, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series).

The Ladder of Creation, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series).

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The Music of the Spheres, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series).

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The Physicists: Playing Dice with the Universe, Holeel-Lietman Productions, Toronto: Released by Document Associates, 1975.

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The Relation of Mathematics to Physics, BBC-TV, London: Released by Time-Life Films, 1965. (The Character of Physical Law series).

San Francisco: The City That Waits to Die, BBC-TV, London: Released by Time-Life Films, 1971.

Science and Foresight, BBC-TV, London: Released by Time-Life Films, 1967.

The Starry Messenger, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series)

Strangeness-Minus Three, BBC-TV, London: Released by Time-Life Films, 1965.

The Sunbeam Solution, Time-Life Films, New York: Released by Time-Life Films, 1974.

Where Do We Grow From Here? Ealing Corporation, Released by BFA--Educational Media, 1974.

World Within World, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series).

APPENDIX I

Science and Society Questionnaire

Return to A. McAlexander

Position of person filling out questionnaire: _____

Science and Society Questionnaire:

The Humanities and Physical Science Departments at Central Piedmont Community College are working on a design for a course about science and technology and its interaction with various other human endeavors. We wish to solicit your input in constructing a course which will fill a genuine need for a large cross section of people in the community.

If you can spare the time to complete this questionnaire and return it to me by campus mail your contribution to the development of the course will be greatly appreciated.

I. General:

Please circle the answer which most nearly reflects your reaction to the question. If none of the responses listed are appropriate, fill your own in the space provided.

1. Do you feel that there is a real need for a nontechnical course about the impact of science and technology on other human endeavors?
   a. There exists a tremendous need.
   b. There exists some need.
   c. Such a course would be interesting, but of little consequence.
   d. There exists no need for such a course.
   e. Any effect of such a course would probably be a negative one.
   f. Other response: _____

2. To which of the following groups do you feel that a course in this area might appeal. (Circle as many answers as are appropriate.)
   a. Associate in technology students (curriculum)
   b. Liberal arts transfer students (curriculum)
   c. Behavioral Science transfer students (curriculum)
   d. Science and Mathematics transfer students (curriculum)
   e. Pre-professional transfer students (curriculum)
   f. Teacher Certificate Renewal
   g. Part-time, special interest students
   h. General cross-section of students
   i. Other: _____

3. Should the course involve any laboratory work?
   a. yes
   b. no
   c. optional

4. Should the course be counted towards the fulfillment of degree requirements for the following areas:
   a. humanities
   b. laboratory science
   c. either a or b
   d. Other: _____

5. Should such a course be team taught or taught by a single intructor?
   a. team taught
   b. single instructor
   c. depends upon the instructors involved.

6. Write any additional comments you wich to make on the course design in the space below.

_____

_____

_____

II. Course Content:

Listed below are some potential topics which might be included in the course being considered. Express your opinion of the importance of these (and any other topics which you might consider appropriate) by circling the appropriate number beside each topic. The scale of importance ranges from of no importance (zero) to critical importance (five).

		of no importance					of critical importance
1.	History of technology	0	1	2	3	4	5
2.	Science and Religion	0	1	2	3	4	5
3.	Science and politics	0	1	2	3	4	5
4.	Science and the Arts	0	1	2	3	4	5
5.	Technology and Quality of Life	0	1	2	3	4	5
6.	Development of Scientific Vocabulary	0	1	2	3	4	5
7.	The Moral Responsibility of Science	0	1	2	3	4	5
8.	Lack of Communications between Humanists and Technologists	0	1	2	3	4	5
9.	The Energy Situation	0	1	2	3	4	5
10.	Pollution: Effects and Alternatives	0	1	2	3	4	5
11.	Population Problems	0	1	2	3	4	5
12.	Technology and Social Structure	0	1	2	3	4	5
13.	Prospects of Nuclear Annihilation	0	1	2	3	4	5
14.	The U. S. Military Budget	0	1	2	3	4	5
15.	Other: _____	0	1	2	3	4	5
16.	Other: _____	0	1	2	3	4	5

III. Course Materials:

Please list any books or films with which you are familiar which you consider to be appropriate resources for the course in the space below.

APPENDIX II

Results of Science and Society Questionnaire

Return to A. McAlexander

Position of person filling out questionnaire: _____

Science and Society Questionnaire:

The Humanities and Physical Science Departments at Central Piedmont Community College are working on a design for a course about science and technology and its interaction with various other human endeavors. We wish to solicit your input in constructing a course which will fill a genuine need for a large cross section of people in the community.

If you can spare the time to complete this questionnaire and return it to me by campus mail your contribution to the development of the course will be greatly appreciated.

I. General: (response indicated in parentheses to the left of answers. Number indicates number of persons who circled that answer.)
Please circle the answer which most nearly reflects your reaction to the question. If none of the responses listed are appropriate, fill your own in the space provided.

1. Do you feel that there is a real need for a nontechnical course about the impact of science and technology on other human endeavors?
(14) a. There exists a tremendous need.
(6) b. There exists some need.
c. Such a course would be interesting, but of little consequence.
(1) d. There exists no need for such a course.
e. Any effect of such a course would probably be a negative one.
f. Other response: No way of determining need. Feel interest exists. Need best met by literature course.

2. To which of the following groups do you feel that a course in this area might appeal. (Circle as many answers as are appropriate.)
(5) a. Associate in technology students (curriculum)
(14) b. Liberal arts transfer students (curriculum)
(8) c. Behavioral Science transfer students (curriculum)
(5) d. Science and Mathematics transfer students (curriculum)
(6) e. Pre-professional transfer students (curriculum)
(14) f. Teacher Certificate Renewal
(11) g. Part-time, special interest students
(15) h. General cross-section of students
(4) i. Other: Not Sure. Most appeal to liberal arts. Teachers, if no [illegible] requirem
Political Science majors.

3. Should the course involve any laboratory work?
(8) a. yes
(6) b. no
(8) c. optional

4. Should the course be counted towards the fulfillment of degree requirements for the following areas:
(7) a. humanities
(2) b. laboratory science
(10) c. either a or b
d. Other: depends on content. History. lab sci. only if lab required. Appeal increased if for credit in either area. Strictly elective.

5. Should such a course be team taught or taught by a single intructor?
   (11) a. team taught
   (6) b. single instructor
   (7) c. depends upon the instructors involved.

6. Write any additional comments you wich to make on the course design in the space below. Should not be given for lab. Sci. Credit. May turn into glamour Course + loose potential. Don't make it a History Course. Would Course duplicate ascent of man? Should be offered at time Convenient for Working Community. Experience has shown team teaching to be worth the trouble.

II. Course Content:

Listed below are some potential topics which might be included in the course being considered. Express your opinion of the importance of these (and any other topics which you might consider appropriate) by circling the appropriate number beside each topic. The scale of importance ranges from of no importance (zero) to critical importance (five).

(Number to left indicates Summation of responses for that topic)

		of no importance					of critical importance
(68) 1.	History of technology	0	1	2	3	4	5
(71) 2.	Science and Religion	0	1	2	3	4	5
(80) 3.	Science and politics	0	1	2	3	4	5
(83) 4.	Science and the Arts	0	1	2	3	4	5
(101) 5.	Technology and Quality of Life	0	1	2	3	4	5
(58) 6.	Development of Scientific Vocabulary	0	1	2	3	4	5
(92) 7.	The Moral Responsibility of Science	0	1	2	3	4	5
(83) 8.	Lack of Communications between Humanists and Technologists	0	1	2	3	4	5
(85) 9.	The Energy Situation	0	1	2	3	4	5
(97) 10.	Pollution: Effects and Alternatives	0	1	2	3	4	5
(96) 11.	Population Problems	0	1	2	3	4	5
(99) 12.	Technology and Social Structure	0	1	2	3	4	5
(77) 13.	Prospects of Nuclear Annihilation	0	1	2	3	4	5
(62) 14.	The U. S. Military Budget	0	1	2	3	4	5
15.	Other: New genetics ; Economics	0	1	2	3	4	5
16.	Other: consumer science	0	1	2	3	4	5

III. Course Materials:

Please list any books or films with which you are familiar which you consider to be appropriate resources for the course in the space below.

Recurrent Authors: Toffler, Huxley, Erlich, Lush, Fuller

Recurrent Films: Ascent of Man Series, The Character of Physical Law Series, Inherit the Wind, Future Shock, The City That Waits to Die.

APPENDIX III

Science and Society Objectives

PHY 1300
PHY 1400
Science and Society: Course Objectives

1. To have the student become more aware of the communications gap which exists between persons working in science and technology and the general public and of the dangers to a democratic society which are implicit in such a situation.

   The student may demonstrate such an awareness through exposition on such topics as: (1) poor decisions made by scientifically ignorant political leaders; (2) misinformation on science distributed through mass media; (3) a technological elite making decisions which affect all of us, with out the knowledge, understanding or consent of the majority.

2. To have the student become aware that the "good life", American style, perhaps cannot, and perhaps should not, endure indefinitely. He should also become aware that it is the responsibility of the educational institutions to prepare the people for rapid and drastic change.

   The student may demonstrate this awareness by exposition on such topics as: (1) alternative world systems, based upon known rates of depletion of resources, population increase, increase in pollution, etc.; (2) other form of, or a redefinition of the "good life"; (3) general plans for educating the American public for flexibility, ie. to accept abrupt changes in life style.

3. To have the student become aware of the distinction between linear and exponential rates of change and of the implications of continued exponential rates of growth of population, use of earth's resources, etc.

   The student may demonstrate his awareness by such methods as sketching the general form of linear and exponential curves on graph paper; extrapolating world population, petroleum consumption, etc. at future times from linear and exponential curves and comparing the results; or writing a critique on the corporate attitude that "corporations must grow in order to survive."

4. To have the student become more aware of both the positive and negative effects which technology has had on the quality of life over the past three centuries in various parts of the world.

   Students may demonstrate this awareness through exposition on such topics as (1) changes in the standard of living (particularly in England) due to the industrial revolution; (2) stress involved in living in a technological society; (3) positive and negative effects from the use of pesticides; (4) the automobile and the environment; (5) mass culture and electronic media.

5. To have the student become more aware that science is a legitimate part of his cultural heritage, as are music, literature and art, and that the study of science has merit on a cultural basis alone.

   The student may demonstrate this awareness through exposition on the philosophical writings of such scientist/humanists as Rene Dubos, Buckminster, Fuller, Albert Einstein, Leo Szilard, Goethe, etc.

6. To have the student become aware of the effect which technology has had on literature and the arts, and vice versa, and how the interaction of the two may prove to be of increasing importance in the future.

   The student may demonstrate this awareness through exposition on such topics as: (1) the development of perspective; (2) theories of light and color; (3) modern technology and music; (4) computer generated art.

7. To have the student gain some general knowledge of several of the classical conflicts between science and politics which have occurred in the past, the outcomes of those conflicts, and some of the implications of future conflicts between scientific knowledge and political motivation.

   Students may demonstrate knowledge in this area by exposition on such scientific-political conflicts as: (1) Galileo and the inquisition; (2) The Luddites; (3) Lysenko and genetics; (4) Oppenhimer and the McCarthy commission; (5) Nader and General Motors; (6) The Jewish scientist and Nazi Germany.

8. To have the student become aware of arguments for and against having scientists participate in the decisions made concerning the use of their discoveries; ie. that scientists should perhaps be held accountable, and therefore granted some control over the use of their discoveries.

   The student may demonstrate this awareness by exposition on the role of scientists in the making of such decisions as the use of nuclear weapons, commitment to nuclear power in the future, the decision to ban the use of DDT, etc.

9. To have the student become aware that, as the earths resources diminish, the priorities for use of conventional fuels and other resources must change.

   The student may demonstrate this awareness through exposition on the effects which this depletion of resources may have on agriculture, transportation, home construction, urban dwelling, etc.

10. To have the student become aware that somewhere, perhaps already past or in the near future, there exists a point of diminishing returns between industrial prosperity and the impact of industry on the environment.

    The student may demonstrate this awareness by exposition on such topics as: (1) the environment as an ingredient of the good life; (2) conflicts between industrial affluence and the environment such as strip mining, the personal automobile, etc.; (3) the deterioration of the inner city.

11. To have the student realize that, as situations change, the commercial media will bombard the public with propaganda and misinformation which may be favorable to vested interest business groups, but to the detriment of the general populus.

    The student may demonstrate either support or opposition to this accusation through exposition on such topics as: (1) the use of E.T.V. to offset the effect of commercial media; (2) critique of representations in petroleum corporation advertising; (3) misrepresentation in automotive, appliance, drug, etc. advertising.

12. To have the student become aware of some of the alternative world models which have been developed through computer synthesis, the Delphi technique, and others, and the implications of and alternatives to these models.

    The student may demonstrate this awareness by exposition which describes current and future problems relating to overpopulation, depleting resources, dwindling food supplies, increasing pollution, etc.

13. To have the student become aware of the major proposed energy sources of the future, the probabilities of their widespread usage individually, and the problems and/or dangers associated with a widespread commitment to each of them.

    The student may demonstrate this awareness through exposition on such topics as: (1) conventional nuclear reactors; (2) the Faustian commitment to the breeder reactor; (3) solar energy; (4) geothermal energy

14. To have the student become aware of scientific endeavor in other cultures, and that the western concept of the scientific method is not considered by all civilizations to be the criterion of rationality.

    The student may demonstrate this awareness by exposition on such topics as: (1) Early Greek Science; (2) Medieval medicine; (3) Moslem science; (4) cosmology and astrology.

15. To have the student become aware that creativity is as essential an ingredient of science and technology as it is in the arts and humanities.

The student may demonstrate this awareness by exposition on such topics as: (1) the contention that physics is a form of philosophy; (2) the idea that many eminent scientists have also been highly creative in the arts; (3) the importance of imagination in scientific research.

APPENDIX IV

Evaluation of Course Objectives

PHY 1300/1600, SCIENCE and SOCIETY

Evaluation of Course Objectives

I. Please respond to each of the objectives in the provided list on the basis of the criteria below. Please respond on a scale of from one (the objective does not meet the stated criterion at all) to five (The objective meets the criterion extremely well).

	Generally a desirable objective for science/humanities.	A suitable objective for the Science and Society cours	A realistic expectation of the student.
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

II. Use the back of this sheet to list any additional objectives which you feel are appropriate for the course.

III. Use the back of this sheet to list any additional evaluation procedures which you think would be appropriate for students enrolled in this course.

APPENDIX V

Results of Evaluation of Course Objectives

PHY 1300/1400: SCIENCE and SOCIETY

Evaluation of Course Objectives

I. Please respond to each of the objectives in the provided list on the basis of the criteria below. Please respond on a scale of from one (the objective does not meet the stated criterion at all) to five (The objective meets the criterion extremely well).

(Numbers in Squares indicate the Mean Value assigned by respondents.)

	Generally a desirable objective for science/humanities.	A suitable objective for the Science and Society course.	A realistic expectation of the student.
1	4.50	4.75	4.69
2	4.50	4.63	4.25
3	4.38	4.75	4.13
4	4.25	4.50	4.38
5	4.63	4.63	4.25
6	4.13	4.50	4.25
7	4.38	4.63	4.50
8	4.19	4.50	4.25
9	4.50	4.56	4.50
10	4.13	4.63	4.44
11	3.44	4.25	4.19
12	4.25	4.63	4.38
13	4.50	4.56	4.31
14	3.63	4.13	3.69
15	4.38	4.25	4.44

II. Use the back of this sheet to list any additional objectives which you feel are appropriate for the course.

III. Use the back of this sheet to list any additional evaluation procedures which you think would be appropriate for students enrolled in this course.

APPENDIX VI

Recommended Reference List for Science and Society

Recommended Reference List for Science and Society:

Books:

American Academy of Arts and Sciences. Toward the Year 2000: Work in Progress. ed. Daniel Bell. Boston: Houghton Mifflin, 1968.

Ben-David, Joseph. The Scientists Role in Society. Englewood Cliffs: Printice Hall, 1971.

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Fisher, John C. "The Energy Crisis in Perspective", Physics Today, Vol. 26, No. 12 (December 1973).

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Horgan, J. D. "Technology and Human Values: Circle of Action," Mechanical Engineering, August 1973.

Ikle', Fred C. "The Nether World of Nuclear Megatonnage," The Bulletin of the Atomic Scientists, January 1975.

Jacobsen, Sally, "The Great Montana Coal Rush" Science and Public Affairs, April 1973.

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Nisbet, Ian C. T. "Banning DDT: An Ill-Planned Biochemical Experiment, "Technology Review, Vol. 77, No. 2, December, 1974.

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"The Scientist in Politics", The Bulletin of the Atomic Scientists, (entire publication) February, 1975.

Scrimshaw, Nevin S. "The World Wide Confrontation of Population and Food Supply", Technology Review.

Shaw, Edgar A. G. "Noise Pollution - What Can Be Done?" Physics Today, Vol. 28, No. 1, January, 1975.

Sivard, Ruth Leger. "Let Them Eat Bullets", The Bulletin of the Atomic Scientists. April, 1975.

White, David C. "The Energy - Environment - Ecomomic Triangle", Technology Review, Vol. 76, No. 2, December, 1973.

Films:

The Building of the Bomb, BBC-TV, London: Released by Time-Life Films, 1965.

The Drive for Power, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series).

Einstien, BBC-TV, London: Released by Time-Life Films, 1965.

Energy: A Matter of Choice, Encylcopedia Britannica Films, 1973.

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The Majestic Clockwork, BBC-TV, London: Released by Time-Life Films, 1973. (Ascent of Man series).

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The Physicists: Playing Dice with the Universe, Hobel-Lietman Productions, Toronto: Released by Document Associates, 1975.

Powers of Ten, Charles Eames Films, Venice, California: Released by Charles Eames Films, 1968.

Probability and Uncertainty, BBC-TV, London: Released by Educational Development Center, 1965. (The Character of Physical Law series).

The Relation of Mathematics to Physics, BBC-TV, London: Released by Educational Development Center, 1965. (The Character of Physical Law series).

San Francisco: The City That Waits To Die, BBC-TV, London: Released by Time-Life Films, 1971.

The Starry Messenger, BBC-TV, London: Released by Time Life Films, 1973. (Ascent of Man series).

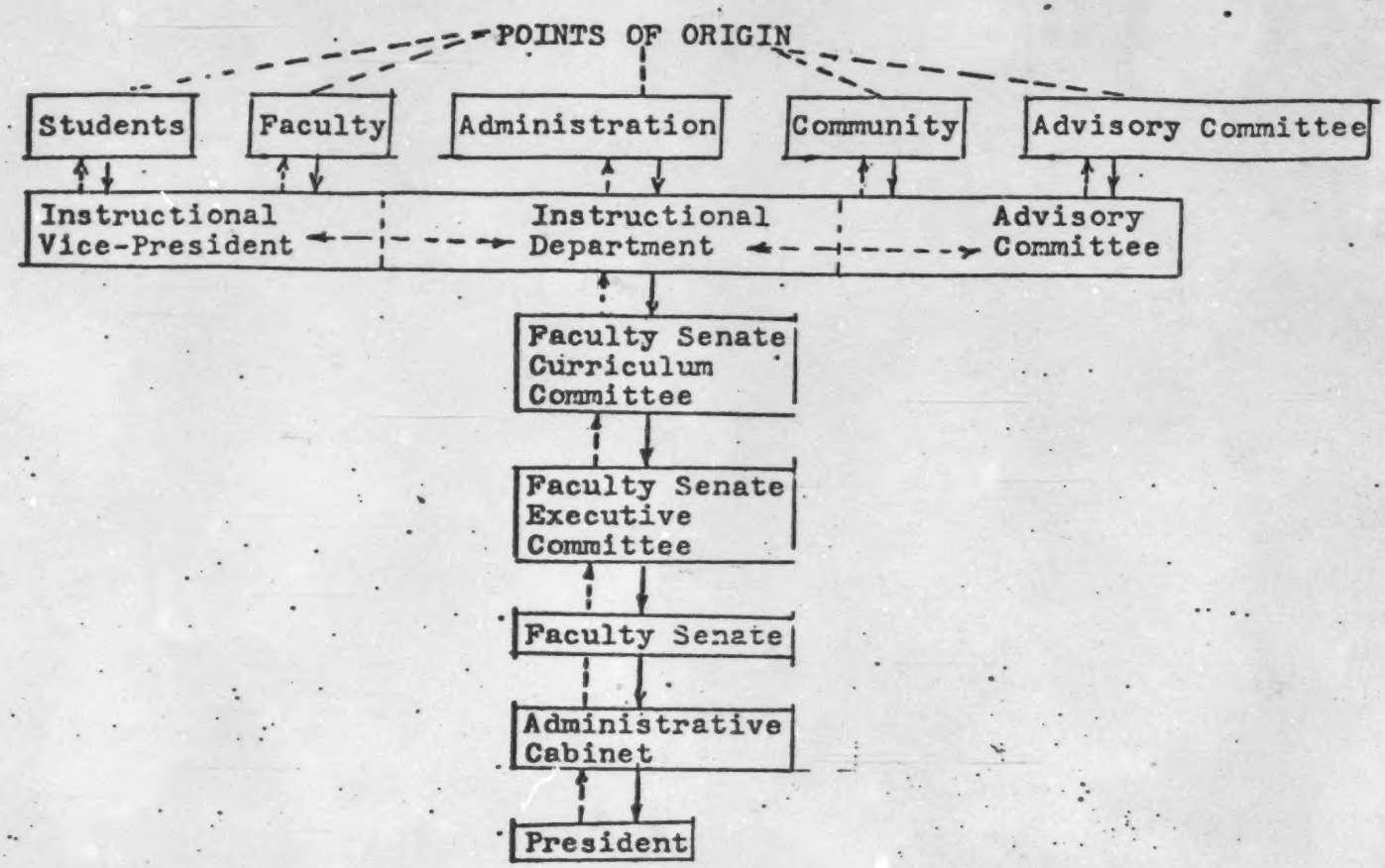
The Sunbeam Solution, Time-Life Films, New York: Released by Time Life Films, 1974.

Where Do We Grow From Here? Ealing Corporation. Released by BFA-Educational Media, 1974.

APPENDIX VII

Procedure Used to Initiate New Course

PROCEDURE USED TO INITIATE NEW COURSES OR CHANGES IN EXISTING PROGRAMS



APPENDIX VIII

Course Outline and Rationale

COURSE OUTLINE

CENTRAL PIEDMONT COMMUNITY COLLEGE

Date: 7-21-75

Course Number and Title: PHY 1300/1400 Science and Society

Credit Hours: 3 or 4 Lecture Hours (per wk.) 3 Lab Hours: 2 (optional)

Prerequisite: None

Instructor submitting this outline: Aaron McAlexander

Is there a course outline from the state curriculum lab for this course? Yes ____ No X

Course Objectives:

General Objectives of the Course: To have the student develop an awareness of the widening communications gap between the sciences and the humanities, and the dangers thereof. To have the student become aware that science and technology are very much a part of our cultural heritage, just as are art, literature, music, etc., and that each has had its influence on the other. To have the student become aware of the threats to future civilized society on this earth, some of the potential solutions to these threats, and some non-solutions which vested interests may impose on a scientifically illiterate populus.

Text(s) Used, including lab manuals: Truitt and Solomons, Science Technology and Freedom. Houghton Mifflin, 1974. Schroeer, Physics and Its 5th Dimension: Society, Prentice Hall, 1973. (Paperbacks)

Other Instructional Materials: 16 mm Films (17 of them), Laboratory Handouts, guest lecturers and discussion leaders from other departments.

Methods of Instruction Used: Films, discussion, reviews, lectures, projects.

IN THE FOLLOWING WEEKLY SUMMARY, PLEASE GIVE THE TOPICS COVERED, WITH SPECIFIC REFERENCE TO THE TEXT USED, LABORATORY TOPICS OR EXERCISES, AND OTHER MATERIALS USED IN THE GIVEN WEEK

First Week: Science, Technology and Culture: Conflicts in values and the dichotomy of two cultures; rationale for course. Schroeer, Chapters 1 & 3, Truitt and Solomons, pp. 4-15 and 45-57. Film: Powers of Ten . Lab: Systems of Measurement

Second Week: The Origins of Science: Early scientific thought, particulary Greek Science and Culture. Schroeer: Chapter 6, Truitt & Solomons pp. 64-78

Films: The Hidden Structure; The Role of Mathematics in Science

Lab: Graphing

Third Week: The History of Science: Myth, Cosmology and astrology are main topics. Schroeer: Chapter 5

Films: The Mystery of Stonehenge; The Music of the Spheres

Lab: Kepler's 2nd Law

Fourth Week: The Scientific Revolution: The Impact of Copernicus, Galileo, Newton, Darwin, et.al. also Romanticism vs Mechanism. Schroeer: Chapters 7, 8, 9; T & S: pp. 100-117

Films: Starry Messenger ; Majestic Clockwork.

Lab: Separation of Light

Fifth Week: Science and Quality of Life: The World we have lost vs the post-industrial society. Schroeer: Chapters 2 & 10; T & S; 41-44.

Film: The Drive for Power

Lab: Simple Machines

Sixth Week: The Modern Scientific Revolution: Attempts to define what we can and cannot know. Schroeer: Chapters 13 & 14.

Films: Probability and Uncertainty; Einstien

Lab: Simple Lens Experiments

Seventh Week: Science and Political Ideology: The Nazi Rejection of "Jewish Science" The Lysenko Affair, The McCarthy Hearings are a few of many hot potential topics. Schroeer: Chapters 16 & 21, T & S: pp 169-183. Film: Knowledge & Certainty

Lab: Optical Slits

Eighth Week: Science and Moral Responsibility: Nuclear and other two-edged swords. Measuring E.W. (Ethical Quotient). Schroeer: Chapters 17, 18, 19 & 20. T & S: pp. 132-143.

Film: The Building of the Bomb

Lab: The Inverse Square Law

Ninth Week: Science and Economics: How to slice the science pie. The Military-Technology love affair, and other controversial topics. Schroeer: Chapters 22, 24, 25. T & S; pp. 35-41 and 252-263. Film: The City That Waits to Die.

Lab: AC and DC

Tenth Week: Science and the Future: Population, Pollution, Plutonium, and a few other problems. Schroeer: Chapters 26 and 27. T & S: pp. 230-251.

Films: The Nuclear Alternative; The Sunbeam Solution; and Where Do We Go From Here?

Lab: Half-life of An Isotope

Eleventh Week: Fighting Existential Nausea: Can we survive affluence?

Truitt & Solomons: pp. 182-202, 264-273

Films: Future Shock and Powers of Ten

Rationale:

As early as 1959, C. P. Snow was expressing concern over the widening breech of communications between the "two cultures", the technologists and the humanists. I, personally, am convinced that the looming problems of the last part of the twentieth century can be solved (non-catastrophically) in a democratic society if and only if our educational institutions are successful in educating the electorate as to what these problems are, what potential solutions exist, and that for these solutions to be put into effect, the voice of the enlightened masses must be heard over the din of lobbying vested interest groups.

Admittedly, educating an entire society is a bit of a quixotic task for one department's efforts, but in the process of discussing the above concerns with the chairman of the Central Piedmont Community College Humanities Department, Mr. Sidney Stovall, we decided that a project might be undertaken which would be of value both at the mundane level of helping students gain certain credits necessary for the attainment of their degrees, and at the more esoteric level of instituting a small effort toward saving the world from going to hell on rollerskates.

This project is to be a course in Science and Society, or Physics and Humanities, or Technology and the Future of Man, or whatever the final, specific direction of the course may turn out to be. But basically, the project will be to design a course, not in science, but about science; a course which will describe the effect which scientific revolutions have had on our culture up to the present, and lead into the major problems of the current and future world and the technological and humanitarian alternatives to armageddon in our time.

Alvin Toffler (1970) contends that we are playing a dirty trick on our students when the educational process consists of hour upon hour of instructing the students in the glories of the past, giving them perhaps a flash of the present, and then remaining silent about tomorrow. Both Toffler (ibid) and John T. Hardy (1975) refer to this, the 800th lifetime of modern man, which represents such a sharp break with all past human experience. Hardy (ibid) quotes Loren Eisley: "The need is not really for more brains, the need is now for a gentler, a more tolerant people than those who won for us against the ice, the tiger, and the bear." or to quote Pogo's most famous paraphrasal, "We has met the enemy and he is us."

As a science teacher, I am convinced of the importance of providing quality education in the basic sciences for our future scientists, technicians, and engineers. But I must admit that the typical physics course for non-science majors has its shortcomings. For example; in terms of teaching students about the role of science in other human endeavors, and in terms of preparing them to make intelligent decisions regarding the future directions of science and technology and the results thereof, most of the course has all the value of barehanded fish grabbing and little wooley horse clubbing (J. Abner Peddiwell, 1939).

The course which we intend to develop will borrow a great deal from Jacob Bronowski's (1973) monumental work, The Ascent of Man, with the addition of considerable emphasis on futurism. It is hoped that the Central Piedmont Community College Curriculum Committee will approve a course in which a student could receive either humanities or laboratory science credits.

A. McAlexander
July, 1975

APPENDIX IX

Course Evaluation Form

CENTRAL PIEDMONT COMMUNITY COLLEGE

Physical Science Department

Instructor: _____ Course Number and Section: _____

Quarter: Fall ___ Winter ___ Spring ___ Summer ___ , 19___

COURSE QUESTIONNAIRE

TO THE STUDENT: The primary purpose of this questionnaire is to provide you with an opportunity to express your opinions concerning this course. Your constructive opinions will be considered when this course is taught again in the future. This questionnaire has been set up in such a manner that you can answer all questions without revealing your name through your handwriting. Do Not Sign (unless you desire to do so). The questionnaire is divided into two sections; please read the instructions for each section carefully. You are to complete only one section.

SECTION I. If you completed the course, skip to Section II. If you did not complete the requirements for this course, please check one or more of the following reasons.

_____a. Course work too difficult

_____b. Not enough time to complete

_____c. Lost interest in course

_____d. Work schedule interfered

_____e. Moved from area

_____f. Personal objectives were met

_____g. Transportation problem

_____h. Left school to take job

_____i. Registered for wrong course

_____j. Illness: Personal ___ Family ___

_____k. Other reasons (please print)_____

_____

SECTION II. For students that did complete the course. The questions in this section are stated so that you may answers on a sliding scale. If your answer is extremely close to one of the words, mark space A or E on your answer sheet. If your feeling is neutral, mark space C. If your feeling is not extreme but strong, mark space B or D on your answer sheet.

		A	B	C	D	E	
1. The requirements for a specific grade in this course were made:	UNCLEAR						CLEAR
2. The objectives of the course were made:	UNCLEAR						CLEAR
3. The objectives of this course seem related or unrelated to your personal goals:	UNRELATED						RELATED
4. The amount of individual help and consultation from your instructor was:	INADEQUATE						VERY SUFFICIENT
5. The accomplishment of the course objectives were:	FEW						MANY
6. This course is:	WORTHLESS						VALUABLE
7. This course is:	DIFFICULT						EASY
8. This course makes me feel:	NOT INVOLVED						INVOLVED
9. This course is:	UNIMPORTANT						IMPORTANT
10. This course is:	DULL						INTERESTING
11. This course is:	IMPERSONAL						PERSONAL
12. This course is:	UNFAIR						FAIR
13. This course is:	TRADITIONAL (same)						INNOVATIVE

14. Suggestions for course improvement or other comments. PLEASE PRINT. _____

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